

What is claimed is:

CLAIMS

5 1. A method for providing a haptic sensation to a user physically contacting a haptic feedback device, said haptic feedback device communicating with a host computer implementing a graphical environment, the method comprising:

receiving an indication of an interaction of a user-controlled cursor with a graphical object in said graphical environment; and

enabling the output of a tactile sensation during said interaction, said tactile sensation being based on a periodic waveform and having a frequency correlated with a size of said graphical object interacted with said cursor.

2. A method as recited in claim 1 wherein said frequency of said tactile sensation is correlated with a size of a collection of data associated with said graphical object.

5 3. A method as recited in claim 1 wherein said frequency of said tactile sensation is correlated with a displayed size of said graphical object.

4. A method as recited in claim 1 wherein said interaction includes moving said cursor over said graphical object in said graphical environment.

20 5. A method as recited in claim 1 wherein said interaction includes a dragging of said graphical object by said cursor such that said graphical object moves where said cursor moves.

6. A method as recited in claim 1 wherein a magnitude of said tactile sensation is also correlated with said size of said graphical object.

25 7. A method as recited in claim 1 wherein said frequency correlated with said size of said graphical object includes a higher frequency for smaller graphical objects and a lower frequency for larger graphical objects.

8. A method as recited in claim 1 wherein a duration of said tactile sensation is also correlated with said size of said graphical object.

9. A method as recited in claim 8 wherein a shorter duration is correlated with smaller graphical objects and a longer duration is correlated with larger graphical objects.

10. A method as recited in claim 1 wherein said graphical object is one of an icon, window, and graphical button.

11. A method for providing a haptic sensation to a user physically contacting a haptic feedback device, said haptic feedback device communicating with a host computer implementing a graphical environment, the method comprising:

receiving an indication of a position of a user-controlled cursor;

causing said cursor to snap to said graphical object when said cursor is within a predetermined distance of said graphical object in said graphical environment so that said cursor is displayed touching said graphical object and said cursor can be moved along or within said graphical object based on user manipulation of said haptic feedback device; and

enabling the output of a vibration sensation to the user while said cursor is moved along or within said graphical object.

12. A method as recited in claim 11 wherein said vibration sensation is based on a periodic waveform.

13. A method as recited in claim 11 wherein said graphical object is a line and said vibration is enabled to be output when said cursor moves along said line.

14. A method as recited in claim 11 wherein said vibration sensation has a frequency correlated to a current velocity of said haptic feedback device in at least one degree of freedom of the haptic feedback device.

15. A method as recited in claim 11 wherein said vibration sensation has a magnitude correlated to a current velocity of said haptic feedback device in at least one degree of freedom of the haptic feedback device.

16. A method as recited in claim 11 further comprising ignoring input from said haptic feedback device based on user manipulation of said haptic feedback device that would cause said cursor to move away from said graphical object.

17. A method as recited in claim 16 wherein said predetermined distance is a first predetermined distance, and wherein said input that would cause said cursor to move away from said graphical object is ignored when said input designates cursor locations within a second predetermined distance from said graphical object.

18. A method as recited in claim 17 wherein said first predetermined distance is equal to said second predetermined distance.

19. A method for providing a tactile sensation to a user physically contacting a haptic feedback device, the method comprising:

enabling the output of a pop sensation, said pop sensation being a short, high magnitude sensation; and

enabling the output of a ringing sensation during or immediately after said output of said pop sensation, said ringing sensation being commanded using a periodic waveform and having a longer duration and lower magnitude than said pop sensation.

20. A method as recited in claim 19 wherein said ringing sensation fades in magnitude over time.

21. A method as recited in claim 19 wherein said haptic sensation is a rubbery sensation having a ringing sensation that is commanded using a periodic waveform having a frequency of 125 to 200 Hz and a duration of about 200 milliseconds.

22. A method as recited in claim 21 wherein an initial magnitude of said ringing sensation is about 40% of a magnitude of said pop sensation.

23. A method as recited in claim 22 wherein said magnitude of said ringing sensation fades over said 200 millisecond duration, wherein an ending magnitude of said ringing sensation is less than 20% of said magnitude of said pop sensation.

24. A method as recited in claim 19 wherein said haptic sensation is a metallic sensation having a ringing sensation that is commanded using a periodic waveform having a frequency of 300 to 500 Hz and a duration of about 200 milliseconds.

25. A method as recited in claim 24 wherein an initial magnitude of said ringing sensation is 10-20% of a magnitude of said pop sensation.

26. A method as recited in claim 25 wherein said magnitude of said ringing sensation fades over said 200 millisecond duration, wherein an ending magnitude of said ringing sensation is about zero.

5 27. A method as recited in claim 19 wherein said haptic feedback device is in communication with to a host computer that displays a graphical environment, wherein an event or interaction in said graphical environment causes said haptic sensation to be output.

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